इंटरनेट मानक

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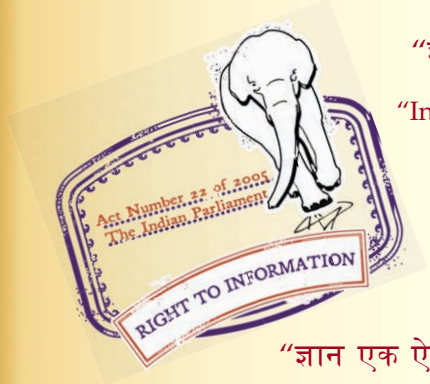
"जानने का अधिकार, जीने का अधिकार"
Mazdoor Kisan Shakti Sangathan
"The Right to Information, The Right to Live"

"पुराने को छोड नये के तरफ"
Jawaharlal Nehru
"Step Out From the Old to the New"

IS 10236-16 (1988): Procedure for basic climatic and durability test for optical instruments, Part 16: Solar radiation test [PGD 22: Educational Instruments and Equipment]



"ज्ञान से एक नये भारत का निर्माण"
Satyanarayan Gangaram Pitroda
"Invent a New India Using Knowledge"

"ज्ञान एक ऐसा खजाना है जो कभी चुराया नहीं जा सकता है"
Bhartṛhari—Nītiśatakam
"Knowledge is such a treasure which cannot be stolen"

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Indian Standard

(Reaffirmed 1998)

PROCEDURE FOR BASIC CLIMATIC AND DURABILITY TESTS FOR OPTICAL INSTRUMENTS

PART 16 SOLAR RADIATION TEST

1. Scope — Covers the procedure for conducting solar radiation test for optical instruments.

2. Terminology — For the purpose of this standard, the definitions given in IS : 10236 (Part 1) 'Procedure for basic climatic and durability tests for optical instruments : Part 1 General (*under preparation*)'.

3. Object — To determine the suitability of optical instruments for use or unsheltered storage under conditions of solar radiation as experienced on the earth's surface or in the lower atmosphere.

4. Initial Measurements

4.1 The instrument shall be visually examined, and optically electrically and mechanically checked as required by the relevant instrument specification.

5. Test Chamber

5.1 The chamber used for this test shall have characteristics as specified in **5.1.1** to **5.1.7**.

5.1.1 The chamber shall be provided with means of obtaining simulated solar radiation of an irradiance of 1 120 W/m² ± 10 percent, over the prescribed irradiation measurement plane with the spectral distribution given in Table 1. The value 1 120 W/m² shall include any radiation reflected from the test enclosure and received by the specimen under test. It should not include long wave infra-red radiation emitted by the test enclosure.

TABLE 1 SPECTRAL ENERGY DISTRIBUTION AND PERMITTED TOLERANCES

Spectral Region	Band Width μm	Irradiance W/m²	Irradiance Percentage	Irradiance Tolerance Percent
Ultra-Violet B*	0·28-0·32	5	0·4	±35
Ultra-Violet A	0·32-0·40	63	5·6	±25
Visible	0·40-0·52	200	17·9	±10
	0·52-0·64	186	16·6	±10
	0·64-0·78	174	15·5	±10
Intra-red	0·78-3·00	492	44·0	±20
		1 120	100·0	

*Radiation shorter than 0·30 μm reaching the earth's surface is insignificant.

5.1.1.1 The radiation sources given below are suggested, one of which may be used to obtain the irradiance and spectral distribution as given in Table 1:

a) Xenon or mercury-xenon arc lamp with suitable reflectors and filters (including *IR* filters).

b) Combination of incandescent spot lamp together with tubular type mercury vapour lamp with external reflectors and suitable filters.

c) Combination of incandescent spot lamps (including infra-red filters) together with mercury vapour lamp with internal reflectors and suitable filters.

d) Carbon arc lamp with suitable reflectors and filters.

Adopted 15 April 1988

Gr 2

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Optical and Mathematical Instruments Sectional Committee, EDC 36; Panel for Basic Climatic and Durability Tests for Optical Instruments [Ref : Doc : EDC 36 (4536)]

5.1.1.2 The radiation arrangement shall have means of directing and focussing the beam with a view to obtain a uniform irradiance at the prescribed measurement plane within specification limit (1 120 $W/m^2 \pm 10$ percent).

5.1.1.3 The radiation arrangement shall have facility to replace and clean the optical components, lamps, reflectors and filters, etc, whenever required.

5.1.2 It shall be provided with means to measure the level of irradiance over the prescribed irradiation measurement plane using a pyranometer or any other similar instrument.

Note 1 — Total intensity checks are easy to make but detailed checks on spectral characteristics are much more difficult. Major spectral changes may be checked by inexpensive routine measurement using a pyranometer in conjunction with selective filters. For checking the spectral distribution characteristics of the facility, it would be necessary to employ sophisticated spectro-radio-metric instrumentation or help for this purpose should be taken from a national calibration centre. Correlation would also be achieved between the filter/pyranometer and spectroradiometric measurements at regular intervals.

Note 2 — Changes in spectral characteristics of lamps, reflectors and filters may occur over a period of time which could result in the spectral distribution being seriously outside the permissible tolerances. Manufacturing tolerances may mean that lamp replacement could result in unacceptable changes in both the level of irradiation and spectral distribution compared with that initially set up. Regular monitoring of the spectral distribution within the test facility in detail is therefore essential but it need not be done while a specimen is undergoing test.

5.1.3 It shall have arrangement for measurement of temperature (with adequate shielding from radiated heat) at a point or points in a horizontal plane 0 to 5 cm below the prescribed irradiation measurement plane at half the distance between the instrument under test and the wall of the enclosure, or at one metre distance from the instrument under test, whichever is the lesser.

Note 1 — Because of the high level of the radiation it is essential that temperature sensors are adequately shielded from radiant heating effects. This applies both to measuring air temperatures within the test enclosure and also to monitoring specimen temperatures.

Note 2 — For air temperature measurements a suitable arrangement is a thermocouple freely mounted in radiation shield comprising a vertical cupro-nickel tube (approx 1·5 cm dia x 7 cm) surmounted by spaced metal hood, polished on the inside surface and painted white on the outside.

5.1.4 The chamber shall be capable of raising the temperature within the chamber at an approximately linear rate to 40°C or 55°C and maintaining it there with an accuracy of $\pm$ 2°C. The heating rate shall be slow and shall meet the requirements of the chosen test cycle.

5.1.5 To minimize the reduction in temperature over the specimen(s) it is essential to control the rate of air flow inside the chamber which shall be as low as possible consistent with achieving satisfactory control of temperature.

5.1.6 The chamber shall also be capable of lowering the inside temperature at an approximately linear rate to 25°C and maintaining it there with an accuracy of $\pm$ 2°C. The cooling rate shall meet the requirements of the chosen test cycle.

5.1.7 It shall have sufficient safeguards against:

a) lamp explosions,

b) electric shock due to high voltage requirement of some lamps,

c) ultraviolet radiations outside the chamber and for the observer, and

d) local toxic concentrations of ozone produced during the test duration (which need to be sucked out of the building as it is a big health hazard).

6. Test Severities

6.1 The instrument shall be exposed to one of the following conditions of temperature and irradiation duration as shall be called for in the relevant instrument specification :

a) Irradiation of 8 h, out of which 4 h at 55 $\pm$ 2°C, according to Fig. 1 (A)

b) Irradiation of 8 h, out of which 4 h at 40 $\pm$ 2°C, according to Fig. 1 (A) (This is to be specified if the instrument is to be used only in cold regions)

c) Irradiation of 20 h, out of which 18 h at 55 $\pm$ 2°C, according to Fig. 1 (B)

d) Irradiation of 20 h, out of which 18 h at 40 $\pm$ 2°C, according to Fig. 1 (B) (This is to be specified if the instrument is to be used only in cold regions).

} Number of cycles according to the relevant instrument specification (refer to **7.1.1**)

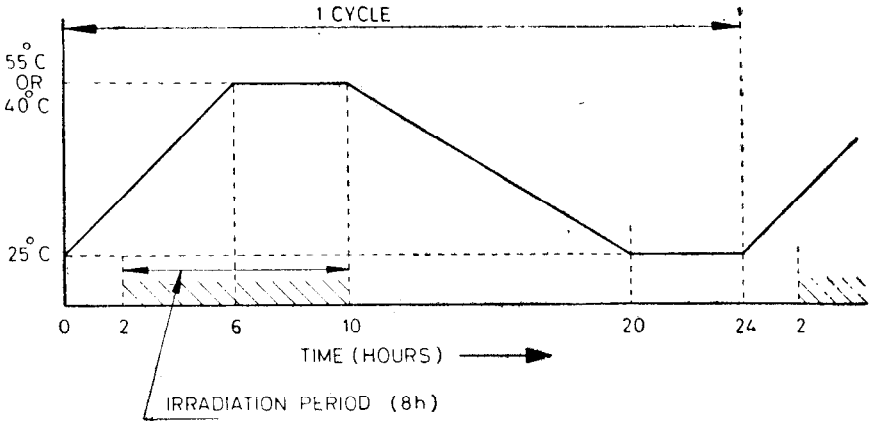

FIG. 1A

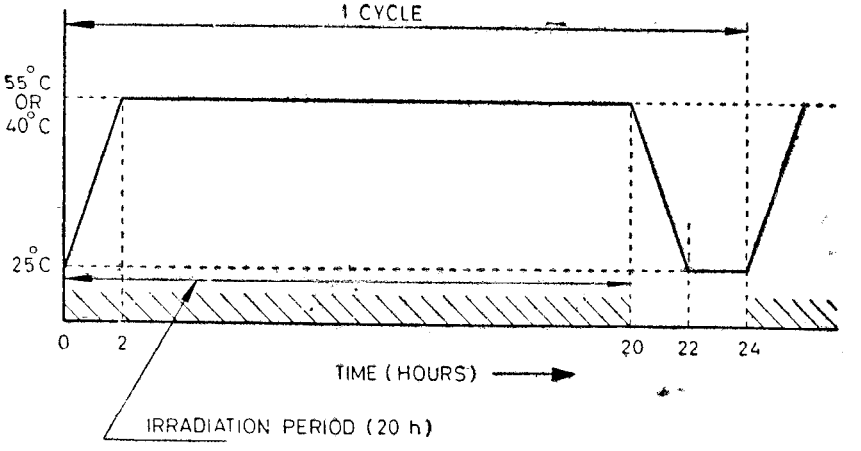

FIG. 1B

7. Test Method

7.1 The instrument shall be subjected to this test in the unpacked condition.

7.1.1 The instrument, while being under the laboratory atmospheric conditions, shall be introduced into the chamber, the latter also being under the same conditions. It shall be placed on the prescribed irradiation measurement plane which is a surface constructed with opaque material of low heat conductivity or it shall be installed on a fixture supported by low heat conduction means very near to the prescribed irradiation measurement plane. While placing/installing instrument, consideration should be given that radiation applies on all instrument surfaces which are liable to receive direct solar radiation in normal use. If important, the orientation should be specified in the relevant instrument specification.

7.1.2 The temperature of the chamber shall then be brought from laboratory temperature to 25 ± 2°C and the test will be taken to commence only after this stabilization.

7.1.3 After this stabilization, the test cycle shall be carried out according to Fig. 1 (A) or 1 (B), whichever is applicable. The requirements for irradiation, temperature and time relationships are clearly indicated in these figures. During the darkness period, the temperature within the chamber shall fall at an approximately linear rate and be maintained at 25 ± 2°C.

7.1.4 The number of cycles to which the specimen should be subjected shall be one of the following which shall be specified in the relevant instrument specification:

a) 3 cycles.

b) 5 cycles, and

c) 10 cycles.

Note — The cycles called for will depend on the object of the test. Where the interest is in heating effects only, then 3 cycles should be adequate. A longer test duration is necessary if degradation effects are to be assessed. For instrument continuously exposed to outdoor conditions, a test duration of 10 cycles of Fig. 1 (B) may be suggested.

7.1.5 The relevant instrument specification shall state whether the instrument is to be operated during test. If so, whether it is to be operated for the whole duration or only for a part of it.

7.1.6 *Recovery* — After specified number of cycles, the instrument shall be removed from the chamber and kept under standard atmospheric conditions for recovery for not less than one hour nor more than two hours.

8. Final Measurements

8.1 After recovery, the instrument shall be visually examined for any surface degradation and tested for its performance in accordance with the relevant instrument specification.

9. Details to be Given in Relevant Instrument Specification

9.1 The relevant instrument specification shall state the following for carrying out this test :

a) Initial observations/measurements;

b) Orientation, if important, in which the instrument should be kept for radiation inside the chamber;

c) Test severity;

d) Number of cycles;

e) Details of operation, if the instrument is to be operated during test;

f) Final observations/measurements; and

g) Any deviation from the normal procedure.

EXPLANATORY NOTE

This standard is one of a series of Indian Standards relating to procedure for basic climatic and durability tests for optical instruments. Fast development in the field of instruments had brought a significant change in their basic content and design. It has been felt over a years that IS : 2352-1963 'Procedure for basic climatic and durability tests for optical instruments' does not cater for the present day needs of the instruments and it is also not in line with the recent trends in climatic and environmental testing procedures to be adopted for meeting their quality and reliability. It is, therefore, necessary to have uniform and more rational testing procedures as far as possible. This series of standards on climatic and durability tests has been prepared with this objective. The other standards in this series are as follows:

IS : 10236 (Part 1) Part 1 General
IS : 10236 (Part 2)-1982 Dry heat test
IS : 10236 (Part 3)-1982 Cold test
IS : 10236 (Part 4)-1982 Damp heat test
IS : 10236 (Part 5)-1982 Damp heat (cyclic) test
IS : 10236 (Part 6)-1982 Salt mist test
IS : 10236 (Part 7)-1983 Mould growth test
IS : 10236 (Part 8)-1983 Thermal shock (rapid change of temperature) test
IS : 10236 (Part 9)-1983 Low air pressure (altitude) test
IS : 10236 (Part 10)-1985 Bump test
IS : 10236 (Part 11)-1985 Vibration test
IS : 10236 (Part 12)-1985 Shock test
IS : 10236 (Part 13)-1986 Dust test
IS : 10236 (Part 14)-1986 Driving rain test
IS : 10236 (Part 15)-1986 Drop test
IS : 10236 (Part 17)-1988 Acceleration (steady state) test
IS : 10236 (Part 18)-1988 Sealing test

It is proposed to withdraw IS : 2352-1963 as soon as the tests mentioned therein are covered in the new series of IS : 10236 are published.

While preparing this standard, considerable assistance has been derived from the details supplied by the leading inspection authorities and manufacturers of this product as well as from DIN 58390 Teil 9-1985 'Sun radiation (Solar Radiation), issued by the Deutsches Institute für Normung (DIN).

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